REMARKS

Claims 1, 4-7, and 10 are pending in the present Application. No claims have been canceled, Claims 1, 4, 5, and 10 have been amended, and no claims have been added, leaving Claims 1, 4-7, and 10 for consideration upon entry of the present Amendment.

Amendments to Claims

Claim 1 has been amended to include elements of (c) a conductive agent, (d) a binder, to recite that the cathode consists of the recited elements (a)-(d), and to specify that the metal hydroxide is present as particles, which are uniformly mixed with the cathode active material particles. Support for these amendments can be found at least in the Specification, published as PCT/KR2004/001897, on p. 4, line 9-15 and p. 9, lines 8-12.

Claims 4 and 10 have each been amended to specify that the metal hydroxide is particles.

Claim 5 has been amended to specify metal hydroxide particles, and that the metal hydroxide particles and the cathode active materials particles are uniformly mixed with each other. Support for these amendments can be found at least in the Specification, published as PCT/KR2004/001897, on p. 4, line 9-15 and p. 9, lines 8-12.

Further support for the term "uniformly mixed" in Claims 1 and 5 can be found in the Examples (see e.g., Example 1) in which it is disclosed that the cathode active material, trihydroxyaluminum particles (i.e., a metal hydroxide) and conductive agent and binder "are added to prepare mixed slurry for a cathode" where it will be appreciated that a mixed slurry is a homogeneous dispersion of all of these ingredients, and hence each component, e.g., the cathode active material and metal hydroxide, etc, is uniformly mixed with each other as claimed. Applicants therefore believe based on the teachings of the disclosure that uniformity in these components when mixed is intrinsic to the disclosure. Please note especially that the metal hydroxide *particles* are disclosed where it is stated in the Specification that "$Al(OH)_3$ having an average particle size of 0.8μm" is used. See e.g., p. 9, Example 1. Such a slurry is applied to a current collector, dried, and then pressed to have a structure in which the cathode active material particles and the metal hydroxide particles are uniformly mixed with each other (see Fig. 2 below).

Reconsideration and allowance of the claims are respectfully requested in view of the

above amendments and the following remarks.

Claim Rejections Under 35 U.S.C. § 103(a)

Claims 1, 4, 5, and 10 stand rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over U.S. Patent No. 6,998,071 ("Maeda") in view of U.S. Patent No. 4,913,988 ("Langan").

Claim 6 stands rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over Maeda in view of Langan, and further in view of Japanese Patent Publication No. 2002-8718 ("Hibara").

Claim 7 also stands rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over Maeda in view of Langan and Hibara and further in view of Japanese Patent Publication No. 2002-83632 ("Unoki").

Applicants therefore respectfully traverse these rejections.

Claim 1claims cathode for a battery, consisting of: (a) cathode active material particles; (b) metal hydroxide particles having a specific surface area of between 2.5 m^2/g and 100 m^2/g, as a cathode additive; (c) a conductive agent; and (d) a binder, wherein the metal hydroxide particles added to the cathode are present in an amount of greater than 0 wt% and less than 10 wt%, and the cathode active material particles and the metal hydroxide particles in the cathode are uniformly mixed with each other.

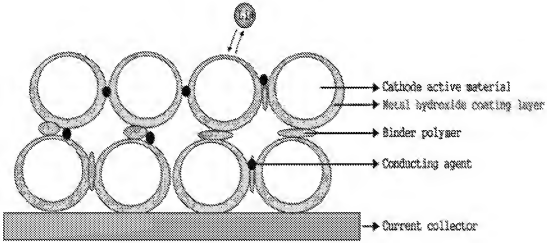
The metal hydroxide included in a cathode component, as claimed in Claim 1, acts to improve storage properties of the battery at a high temperature. It will further be appreciated that metal hydroxides, as claimed in the instant claim, are nonconductors by nature. A metal hydroxide, if added to a cathode in an excessive amount, may therefore *decrease* battery capacity and degrade storage properties of a battery at a high temperature. Thus, a large quantity of cathode active material particles cannot be coated with the metal hydroxide having the aforementioned amount if it is desirable to have the cathode active material particles in electrical contact with each other.

As stated previously, if a cathode active material were *coated* with the metal hydroxide as to form a layer surrounding the cathode active material particles, the cathode active material particles would be unable to make direct contact with one another through the metal hydroxide coating layer formed on the surface of the cathode active material particles,

and cannot therefore be interconnected "physically" and/or "electrically" from the lack of direct contact of the cathode active material particles due to the intervening the metal hydroxide.

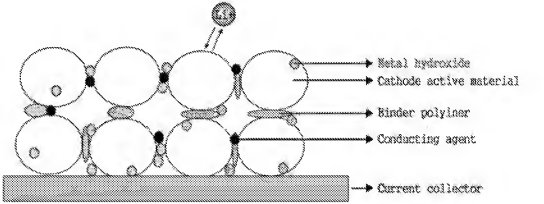
Please again refer to FIG. 1 below (i.e., "metal hydroxide coating layer"), which illustrates this:

FIG. 1



The cathode of Claim 1 is thus characterized by use of the metal hydroxide as a cathode *additive* in a minimal amount and having a specific surface area adjusted to be within a certain range (for example, 2.5 to 100 m^2/g), and not as a coating. Please refer to FIG. 2 below to illustrate this feature.

FIG. 2



By using a metal hydroxide having a large specific surface area as the cathode

additive, it is possible to obtain *both* the excellent storage properties of a battery at a high temperature so as to minimize any decrease in battery capacity, *and* to prevent increase of battery impedance that would result from completely coating the particles with metal hydroxide. These desirable features can be obtained even if the metal hydroxide having a high surface area as claimed is added in a relatively small amount (greater than 0 wt% to less than 10% as claimed in Claim 1). Further, any decrease in the battery capacity that would arise from the inclusion of higher amounts of metal hydroxide to the cathode may be minimized.

The effect of the improvement in storage properties of the battery at a high temperature (i.e., minimizing the decrease in (or loss of) battery capacity, thereby preventing increase of the battery impedance), as described above, is supported by the description in the Specification on pages 12 to 16 (Storage characteristic test at high temperature) and Tables 1-3 in the Specification.

Applicants respectfully traverse the rejections and assert that Maeda in view of Langan fails to teach all elements of the instant claims, and particularly fails to teach that particles of the metal oxide are distributed or dispersed over the surface of the lithium cobalt oxide, in contrast to the continuous coating of metal hydroxide in the disclosure of Maeda; that the combination fails to disclose surface area for metal hydroxide particles; fails to provide a suggestion or incentive that would lead the skilled artisan to provide these features, and fails to provide a suggestion or incentive that would lead the skilled artisan to combine Maeda with Langan as to do so would nonetheless require modifying the combination to exclude an essential element.

For an obviousness rejection to be proper, the Examiner must meet the burden of establishing that all elements of the invention are disclosed in the prior art; that the prior art relied upon, or knowledge generally available in the art at the time of the invention, must provide some suggestion or incentive that would have motivated the skilled artisan to modify a reference or combined references. *In re Fine*, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988). "A patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art." *KSR Int'l Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1741 (2007). To find obviousness, the Examiner must "identify a reason that would have prompted a person of ordinary skill in the art in the relevant field to combine the

elements in the way the claimed new invention does." *Id.*

Applicants respectfully maintain that the combination of Maeda in view of Langan fails to teach all elements of the instant claims. Maeda teaches that the magnesium hydroxide coats the **entire** cobalt oxide particle as illustrated in Fig. 1. Specifically, Maeda discloses, in making the magnesium coated cobalt oxide, that coated cobalt oxide particles (II):

$$[(1-x)Co_3O_4 \cdot 3xMg(OH)_2] \qquad \text{(II)}$$

are prepared by forming cobalt oxide particles in solution, adding magnesium salt to the reaction solution , adjusting pH with aqueous alkali, thereby *coating the surface* of the cobalt oxide particle with magnesium hydroxide. Maeda, Col. 78, lines 23-33. It will be appreciated that the method using dissolved salts coated by pH adjustment as disclosed in Maeda would lead to a uniform coating, in contrast to the coated *slurry* of particles claimed in Claim 1and disclosed in the instant Specification. Maeda therefore does not disclose the coating of the instant claims.

The cobalt oxide particles coated with magnesium hydroxide of Maeda are also not the cathode active material, a distinction made in Maeda, but are *precursor compounds* for forming the cathode active material. Maeda, Col. 6, lines 16~44. Maeda clearly and explicitly states that the cathode active material is prepared from coated cobalt oxide particles (II) by mixing the cobalt oxide particles (I) or (II) with both a lithium compound and an aluminum compound (e.g., $AlOH_3$), and heating the mixture at 600-950°C to form the cathode active material. Maeda, Col. 9, lines 11-15, 39-49.

Maeda further states that the advantages to the *cathode active material* of Maeda (i.e., large lattice constant) are obtained because when the magnesium hydroxide in precursor (II) is "adhered onto the surface of the cobalt oxide particles, magnesium and cobalt are uniformly distributed in the cathode active material at *atomic level*," and that "cobalt sites of the cathode active material obtained by using the cobalt oxide particles… (II) can be uniformly replaced with magnesium." Col. 10, lines 48-59.

Maeda therefore teaches that 1.) only the *precursor* material to the cathode active material (e.g., Co_3O_4, and not a cathode active material such as $LiCoO_2$) are coated with metal hydroxide, and 2.) after forming the cathode active material, the magnesium hydroxide coating is intercalated into the cathode active material at *the atomic level*, which does not indicate the presence of the intermittently coated particles as claimed in Claim 1 and as

illustrated in FIG. 2 above.

Furthermore, Claim 1 does not claim a specific surface area for the cathode active material particles, but only for the metal hydroxide coated cobalt oxide precursor to the cathode active material. One skilled in the art will appreciate that these are not identical.

Maeda discloses *coating* individual cobalt oxide particles with magnesium hydroxide as illustrated in FIG. 1, whereas the metal hydroxide claimed in Claim 1 is included as a cathode additive (i.e. cathode slurry additive) (see FIG. 2, above.

Further, the invention of Claim 1 is characterized by using the metal hydroxide particle as a cathode "**additive**" in a minimal amount, wherein a specific surface area of the metal hydroxide particle is adjusted to be within a certain range (for example, 2.5 -100 m^2/g). Since the claimed invention cannot have a structure of the cathode as described in above FIG. 1, the problems of Maeda (i.e., intermittent interparticle electrical contact) caused by the use of the magnesium hydroxide coating layer fundamentally do not occur in the invention claimed in Claim 1.

Specifically, where a cathode is formed by using cobalt oxide particles coated with the magnesium hydroxide in Maeda, the cathode active material particles cannot make contact directly with one another due to the intervention of the metal hydroxide coating layer formed on the surface of the cathode active material particles, and thus, as discussed above, cannot be interconnected "physically" and/or "electrically" due to **non-conductivity** of the metal hydroxide.

Thus, the surface of cathode active material in Maeda is surrounded with the metal hydroxide coating layer. Since the metal hydroxide is nonconductor and is not capable of lithium ion intercalation/deintercalation, the metal hydroxide coating layer serves as a resistive layer which interrupts lithium ion movement from the cathode active material during charge/discharge cycles, thereby undesirably *increasing* the battery impedance.

Because Maeda forms a cathode by use of the cobalt oxide particles coated with magnesium hydroxide, it is distinguishable from the claimed invention in terms of constitution. Further, the cathode active material particles coated by the metal hydroxide in Maeda cannot be electrically interconnected, thereby causing degradation in battery performance such as good rate property and high output.

It will be appreciated as well that Maeda specifically states that the BET specific

surface area value of 0.5 to 50 m^2/g at a particle diameter of not more than 0.2 μm is for the coated cobalt oxide particles, but not for magnesium hydroxide added as a discrete component to a cathode active material, as claimed in the instant claims, and hence Maeda fails to diclose a surface area for either the metal oxide absent the cobalt oxide, and also significantly, does not provide a surface area for the cathode active material prepared from the coated cobalt oxide particles of (II) in Maeda. Maeda and Langan also disclose, respectively, magnesium hydroxide and calcium hydroxide as a component of the cathode, but further do not disclose *adjusting* the specific surface area of the metal hydroxide to a certain range (e.g., 2.5-100 m^2/g) as claimed in Claim 1. Moreover, the skilled artisan will appreciate that the difficulty in adjusting a metal hydroxide to have a surface area within a certain range such as 2.5-100 m^2/g, even if magnesium hydroxide coating layer is formed on the surface of the cathode active material in Maeda.

Maeda and Langan do not teach or suggest that the specific surface area of the metal hydroxide added to the cathode of the battery is related to the storage properties of the battery at a high temperature, and thus neither of these references provides a suggestion or incentive that would lead one skilled in the art to include a metal hydroxide having a specific surface area as claimed in Claim 1. For at least these reasons, Maeda in view of Langan fails to teach the surface area of the metal hydroxide additive particles, and fails to provide a suggestion or incentive that would lead one skilled in the art to modify the combination to provide the surface area for the metal hydroxide particles.

Also with regard to the combination, Langan, in addition to disclosing calcium hydroxide, includes lithium carbonate (Li_2CO_3) as the "*essential component*" constituting the cathode. Claim 1 does not claim lithium carbonate, and as amended to recite that the claimed composition "consists of" the recited elements, Claim 1 is exclusive of the use of lithium carbonate. As argued previously, to thus remove lithium carbonate from any combination of Maeda and Langan would alter the principle of operation of Langan and therefore would teach away from its use, or any expectation of success for the combination. In this regard, the courts have held that "[i]f the proposed modification would render the prior art invention being modified unsatisfactorily for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon* 733 F. 2d 900, 221 USPQ 1125 (Fed. Cir. 1984). The courts have also held that '[i]f the proposed modification or

combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims prima facie obvious.'" *In re Ratti* 270 F. 2d 810, 123 USPQ 349 (CCPA 1959). There is therefore no suggestion or incentive in Langan to remove an essential element from the combination of Maeda and Langan to recite the elements of Claim 1, and therefore, Maeda in view of Langan does not render Claim 1 unpatentable.

For at least the above reasons therefore, Maeda in view of Langan fails to disclose all elements of the instant Claims 1, and its dependent Claims 4, 7, and 10, and fails to provide a suggestion or incentive that would lead one skilled in the art to modify the combination to provide the missing limitations.

As to the rejections of Claims 6 and 7 over, respectively, Maeda in view of Hibara, and Maeda in view of Hibara and further in view of Unoki, Hibara and Unoki do not remedy the deficiencies of Maeda in view of Langan; and therefore the combinations of Maeda, Langan, and Hibara; and Maeda, Langan, Hibara and Unoki do not disclose all limitations of the instant claims and do not render these claims unpatentable.

It is believed that the foregoing amendments and remarks fully comply with the Office Action and that the claims herein should now be allowable to Applicants. Accordingly, reconsideration and allowance are requested.

If there are any additional charges with respect to this Amendment or otherwise, please charge them to Deposit Account No. 06-1130.

Respectfully submitted,

CANTOR COLBURN LLP

By: /Dana A. Gronbeck/
Dana A. Gronbeck
Registration No. 55,226
CANTOR COLBURN LLP
20 Church Street, 22nd Floor
Hartford, CT 06103
Telephone (860) 286-2929
Facsimile (860) 286-0115
Customer No.: 23413

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